CLAIMS

1. A method for determining a power backoff value for a first modem, the method comprising the steps of:

receiving a signal from a second modem;

determining from the signal, information concerning line conditions on a communications channel between the first modem and the second modem; and

calculating a signal to noise ratio using a geometric mean for a sub-band of a total frequency band for a plurality of rates.

2. The method of claim 1, further comprising the step of:

determining a power backoff value for each of the plurality of rates based on the calculated signal to noise ratio.

3. The method of claim 2, wherein the power backoff value comprises an amount of power backoff in decibels for an estimated line loss.

4. The method of claim 2, wherein the signal comprises a transmit signal and a noise signal and further comprising a step of:

determining a first power spectrum of a transmit signal.

5. The method of claim 4, further comprising a step of:

determining a second power spectrum of a noise signal.

6. The method of claim 5, wherein the steps of determining a first power spectrum and a second power spectrum further comprises the steps of:

computing a discrete Fourier transform of the transmit signal plus the noise signal; and

computing a discrete Fourier transform of the noise signal.

7. The method of claim 2, further comprising the step of:

using the sub-band to optimally shape a spectrum for determining a power backoff value.

8. The method of claim 2, wherein the power backoff value satisfies a bit error rate requirement.

9. The method of claim 2, wherein the steps are performed during a line probe session between a plurality of pre-activation handshaking sessions between a plurality of modems.

10. The method of claim 2, wherein the step of calculating a signal to noise ratio further comprises the steps of:

sampling a noise signal;

computing a discrete Fourier transform of the noise signal; and

estimating a noise power spectral density for the noise signal.

11. The method of claim 10, further comprising the steps of:

sampling a transmit signal;

computing a discrete Fourier transform of the transmit signal; and

estimating a signal and noise power spectral density.

12. The method of claim 11, further comprising the steps of:

computing a signal to noise ratio of a frequency sub-band; and

summing a plurality of sub-bands with signal to noise ratio values greater than a predetermined value.

13. The method of claim 2, wherein the step of determining a power backoff value further comprises the step of:

shaping a spectrum such that at least one frequency with a signal to noise ratio value above a predetermined value is increasingly attenuated.

14. The method of claim 2, wherein the step of determining a power backoff value further comprises the step of:

shaping a spectrum such that at least one frequency associated with a signal to noise ratio value approximately equal to a predetermined threshold is minimally cut back.

15. The method of claim 2, further comprising the step of:

shaping a spectrum such that transmitted power is gradually increased with increasing frequency wherein signal to noise ratio is maintained substantially constant through a passband.

16. The method of claim 2, wherein at least one of the first and second modem operate according to the G.SHDSL standard.

17. The method of claim 2, wherein the power backoff value comprises a maximum power backoff value for a given bit error rate.

18. The method of claim 2, wherein the steps are performed at a customer premise equipment.

19. The method of claim 2, wherein the steps are performed at a central office.

20. A system for determining a power backoff value for a first modem, the system comprising:

a receiving module for receiving a signal from a second modem;

a line condition determination module for determining from the signal, information concerning line conditions on a communications channel between the first modem and the second modem; and

a calculation module for calculating a signal to noise ratio using a geometric mean for a sub-band of a total frequency band for a plurality of rates.

21. The system of claim 20, further comprising:

a power backoff determination module for determining a power backoff value for each of the plurality of rates based on the calculated signal to noise ratio.

22. The system of claim 21, wherein the power backoff value comprises an amount of power backoff in decibels for an estimated line loss.

23. The system of claim 21, wherein the signal comprises a transmit signal and a noise signal and further comprising:

a first power spectrum determination module for determining a first power spectrum of a transmit signal.

24. The system of claim 23, further comprising:

a second power spectrum determination module for determining a second power spectrum of a noise signal.

25. The system of claim 24, further comprising:

a first computing module for computing a discrete Fourier transform of the transmit signal plus the noise signal; and

a second computing module for computing a discrete Fourier transform of the noise signal.

26. The system of claim 21, wherein the sub-band is used to optimally shape a spectrum for determining a power backoff value.

27. The system of claim 21, wherein the power backoff value satisfies a bit error rate requirement.

28. The system of claim 21, wherein the power backoff value is determined during a line probe session between a plurality of pre-activation handshaking sessions between a plurality of modems.

29. The system of claim 21, wherein the calculation module further comprises:

a noise sampling module for sampling a noise signal;

a noise transform module for computing a discrete Fourier transform of the noise signal; and

a noise estimating module for estimating a noise power spectral density for the noise signal.

30. The system of claim 29, further comprising:

a transmit sampling module for sampling a transmit signal;

a transmit transform module for computing a discrete Fourier transform of the transmit signal; and

a signal estimating module for estimating a signal and noise power spectral density.

31. The system of claim 30, further comprising:

a frequency sub- band computing module for computing a signal to noise ratio of a frequency sub-band; and

a summing module for summing a plurality of sub-bands with signal to noise ratio values greater than a predetermined value.

32. The system of claim 21, wherein a spectrum is shaped such that at least one frequency with a signal to noise ratio value above a predetermined value is increasingly attenuated.

33. The system of claim 21, wherein a spectrum is shaped such that at least one frequency associated with a signal to noise ratio value approximately equal to a predetermined threshold is minimally cut back.

34. The system of claim 21, wherein a spectrum is shaped such that transmitted power is gradually increased with increasing frequency wherein signal to noise ratio is maintained substantially constant through a passband.

35. The system of claim 21, wherein at least one of the first and second modem operate according to the G.SHDSL standard.

36. The system of claim 21, wherein the power backoff value comprises a maximum power backoff value for a given bit error rate.

37. The system of claim 21, wherein the system is located at a customer premise equipment.

38. The system of claim 21, wherein the system is located at a central office.

39. The method of claim 1, wherein the signal to noise ratio is calculated by

$$\mathrm{SNR}_{\mathrm{dB}} = \frac{10}{\beta - \alpha + 1}\left(\sum_{k=\alpha}^{\beta} D_k\right)$$

where $0 < \alpha < \beta <$ N-1; $D_k = \begin{cases} D'_k & D'_k > 0 \\ 0 & otherwise \end{cases}$; $D'_k = \log_{10}\left[\frac{|\hat{S}(k)|^2}{|W(k)|^2}\right]$;

where $\hat{S}(k)$ represents an estimate of k^{th} frequency sub-band of a received signal spectrum; $\hat{W}(k)$ represents an estimate of k^{th} frequency sub-band of a received noise spectrum; α represents a starting sub-band; β represents an ending sub-band; D_k represents one or more sub-bands with SNR greater than zero; and D'_k represents SNR for k^{th} sub-band.